ABSTRACT

Title of Thesis: DANCING ARCHITECTURE: A FORMAL APPROACH TO TRANSLATING MOVEMENT AND DANCE

Karen Susana Kim, Master of Architecture, 2017

Thesis Directed By: Michael Ambrose, Clinical Associate Professor

Dance is an outlet that teaches empathy and inspires people to communicate their stories through body movement. Architecture has the same ability to tell stories. I also contend that architecture made of representational narrative in the use of metaphorical forms and tectonics has the ability to teach and communicate. I believe there is a need for architecture to be more open and educational.

Methods and lessons of dance will be applied embodied in ways to induce learning to my architectural thesis. Precedents emphasizing graphic representations of dance movements will support the idea of instructive design. This investigation will entail the work of Étienne-Jules Marey, pioneer of using graphical techniques to depict sequential movement of the human body, and the work of Eadweard Muybridge, an innovator of photographic studies of motion.

The work of my thesis will be to conceive of places for people to congregate, where social and cultural intersections will foster an inspiration for movement or interaction.

DANCING ARCHITECTURE: A FORMAL APPROACH TO TRANSLATING MOVEMENT AND DANCE

by

Karen Susana Kim

Thesis submitted to the Faculty of the Graduate School of the
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Preface

Ever since my younger brother was put into the special education program from 7th and throughout high school, I have been concerned with how the education system handles its students, or the lack thereof. Being deemed as a problem child, his middle school had a meeting to discuss his transfer to another school that had a special education program. In my opinion, my brother's behavior was not egregious enough to be transferred; instead I saw it more as the school giving up on labeled students like him because they did not feel responsible for helping him. In addition, the special education classrooms were lodged into a static, narrow hall-like space that no one ever visited, isolating them from everyone else. I wanted to investigate this for my masters of architecture thesis years later. This made me wonder if the architecture of the school had been better, the social interaction between the students and teachers would have engendered a better environment for everyone.

As an amateur ballet dancer, I thought about how I could mitigate this static architecture with movement, so making a connection between the two was almost second nature. I was fascinated with using my body to make forms and experiencing in another realm whenever I danced. This led me to think that static learning environments at schools could be improved by incorporating motion into its architecture for inducing activity and interaction.

Dedication

I would like to dedicate my thesis to my family for supporting me all these years as a graduate student, for being patient and understanding with all my struggles. I would especially like to thank my brother for being the main inspiration behind my thesis.

Acknowledgements

I would like to thank Professor Michael Ambrose for guiding me through my long journey of thesis. With his extensive knowledge, experience, and deep passion for architecture, I believe that I myself was ignited to keep exploring, keep learning, and to be inspired by even the littlest of things in life.

I would also like to thank our Kea Professor Andrea Ponsi for making the inception of my design possible. I can't imagine what my thesis would be like if I hadn't attended his lecture that one night, while I was struggling with my design. I'd like to furthermore thank him for being here at the School of Architecture, Planning and Preservation at the University of Maryland, sharing his inspirational work to students like myself.

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Chapter 1: Personal History and Dance

Personal Story

The reason why I want to implement the lessons of dance into an elementary school is because of my vicarious experience through my younger brother. In his first year of middle school, he was forced to transfer to another school to be in their special education program, due to his behavioral and academic issues. Initially, our family was very hurt by this, but because we did not know any better, we blindly followed what the county was telling us to do. So since then, he has been in the special education program all throughout middle school and high school. Besides the fact that he was put into the special education program, I had a problem with how his high school arranged the classrooms for students in special education. When I first visited his school to have a meeting with his special education teachers to discuss his progress, I noticed that their classrooms were lodged into a very short hallway that was separate from the rest of the school. I am not proclaiming that special education students should share classrooms with non-special education students, but that the separation is robbing them of experiencing the entirety of the building. Because of this they were being immobilized in just one part of the building, which struck me as a very non-inspiring way to learn. How students could sit in the same classrooms in just one part of the school baffled me as to how this could motivate students to want to learn. This got me to think about incorporating the idea of movement into schools. What would happen if school architecture changed drastically by moving away from rectilinear arrangements, and instead have an irregular arrangement that inspires creativity?

Why Use Dance?

A few years before starting the Master of Architecture program at the University of Maryland, I started ballet. Becoming a dancer helped me think differently about human body movement and taught me how to different parts of the body in ways in which I never thought could be done.

Therefore, for my thesis, I thought the marriage of dance and education would address the issue of the lack of movement, inspiration, and creativity that is crucial to the development of students at a young age.

There is a considerable chronicle of the relationship between architecture and the human body. The more widely used example is human body has been used as a tool to find idealized proportions within buildings; however, this thesis will investigate dance as an extension of human body to explore the more experiential in architecture, using an elementary school as a program. Dance is of interest for my thesis because its ability to offer a didacticism to decode the mechanics and kinetics of the human body which then might inspire movement and activities in educational settings. The central research question of this thesis asks, how can the lessons of dance be used to create an inspired architecture for an elementary school?

Dancing Architecture

The title of this thesis implies *dancing architecture,* which is inspired by the creative visual capture of dance form and movement. It asks the question and poses the argument that movement and experience can be inspired by and embodied in

architecture. By doing this, the school will come alive in the sense that it will invoke curiosity as people are walking inside, wondering what the metaphorical meaning is behind the design. Architecture plays a role in creating an experience and place.

Chapter 2: History of Human Body & Architecture

Da Vinci's Perspective on Vitruvius

Translating the human body into architectural forms has been explored since antiquity. From the personification of orders of columns, to motion capture filming techniques, to Walt Disney's moving pictures, to sports video games; they all utilize diverse visualizations of the human body.

One of the most common examples of conveying human proportions from late 15th century is Leonardo da Vinci's (1452 – 1519) illustration of the ideal Vitruvian man that is based from the Vitruvian text. He references his being inspired by the text by incorporating the concept of beauty formed on Albertian modules. This widely reproduced drawing where he inscribed a human within a circle and in a square [*fig. 1.1*], was a major stepping-stone to a new architectural principles of proportion and composition. Example of this insight into architecture is found in structures with the classical ideal of the central plan, such as Brunelleschi's Old Sacristy and Sangallo's Santa Maria delle Carceri. Even though the idea of a central plan may undoubtedly conjures classical and traditional images, Da Vinci interpreted Vitruvian's text dynamically. Vitruvius addressed the relationship of man in the circle and in the square as separate ideas, but Da Vinci radically changed this by superimposing both

images, which resulted in a single body with four arms and four legs. This dynamism was the rudimentary representation of human body movement[1] and its relevance to architecture.

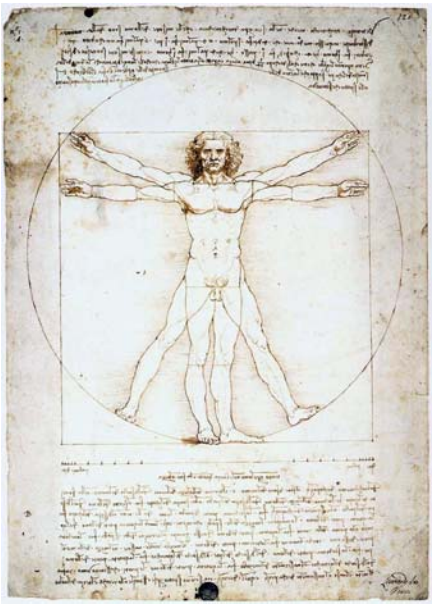

Figure 1. 1: Da Vinci's Vitruvian Man. (Source: https://upload.wikimedia.org/wikipedia/commons/a/a5/Leonardo_da_Vinci-_Vitruvian_Man.JPG). Date accessed: March 8, 2016.

Jumping four centuries ahead, the two pioneers in early 19th century that commenced another method of showing body movement were Étienne-Jules Marey (1830 – 1904) and Eadweard Muybridge (1830 – 1904). Although they both concentrated on the experimentation of graphically showing body movement, they had their own methods in doing so.

Marey was a French scientist, physiologist and most notably, a chronophotographer. As a physiologist he believed that the human body acted as a machine. Marta Braun, professor of the School of Image Arts at Ryerson University

[1] Carlo Pedretti. Leonardo Architect.

whose area of research is chronophotography, particularly the works of Marey and Muybridge, stated, "His idea was based on his understanding, rare in France at the time, that the body itself was a machine, one that consumed fuel and expended energy – a motor, in fact, whose functions could be reduced to the newly discovered (1847) laws of thermodynamics.[2]" He used graphing machines that traced out, in the form of graphs, the functions of the body such as walking in order to record the body's internal dynamic and external kinetics[3] [*fig. 1.2*]. As a chronophotographer, he conceived a series of instantaneous photographs taken at very short and equal intervals of time, which allowed him to analyze body motions [*fig. 1.3*]. By doing this, the visualization of motion appeared as a uniform sequence to a spectator, as if the appearance of the motion itself had been presented[4].

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[2] Eadweard Muybridge, Marta Braun.

[3] Eadweard Muybridge, Marta Braun.

[4] History of Chronophotography, Marey.

Figure 1. 2: Tracing of man walking using a graphing machine. (Source: https://upload.wikimedia.org/wikipedia/commons/c/cb/Marey-_Man_walking,_1890%E2%80%9391.jpg). Date accessed: March 8, 2016.

Figure 1. 3: Series of instantaneous photographs of movements in pole vaulting. (Source: https://upload.wikimedia.org/wikipedia/commons/8/84/%C3%89tienne-Jules_Marey_-_Movements_in_Pole_Vaulting_-_Google_Art_Project.jpg). Date accessed: March 8, 2016.

In England, photographer Eadweard Muybridge worked on photographic studies of motion like Marey as well, but he took this to a slightly different path by leading it into motion-picture projection. At the time, it was impossible to develop instantaneous photographs; thus Muybridge used a multiple of cameras to capture each movement of his subjects as they moved from one position to another, also known as stop-motion photography [*fig. 1.4*].

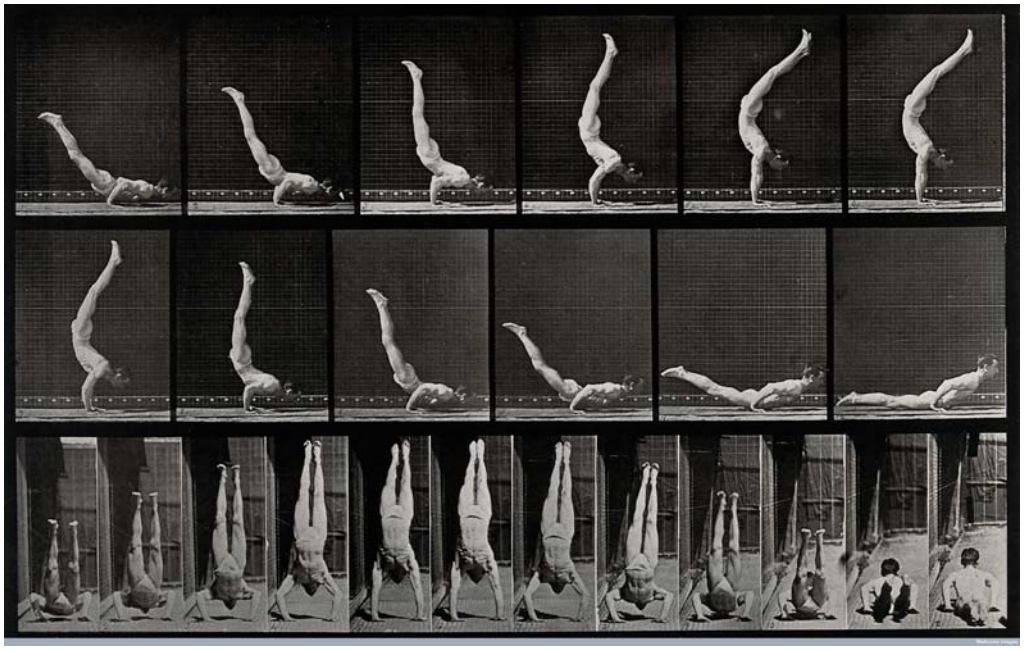

Figure 1. 4: Stop-motion photography of a man standing on his hands from a lying down position. (Source: https://upload.wikimedia.org/wikipedia/commons/a/a4/A_man_standing_on_his_hands_from_a_lying_down_position._Photogravure_after_Eadweard_Muybridge,_1887_-_V0048688.jpg). Date accessed: March 8, 2016.

Movement in Paintings

In early 20th century, dynamism in paintings and the use of time lapse photography began to emerge. With new inventions of transportation such as cars and trains, the focus at the time was on speed and velocity. Along with this transition and wanting to move on from the static and picturesque paintings, the futurist movement surfaced. In

order to promote the fast moving mentality to the world, artists tried to capture movement onto flat canvases. Marcel Duchamp's "Nude Descending the Staircase" [*fig. 1.5*] expresses motion with consecutive figures superimposed on top of one another. This is reflective of Marey's tracing of the man walking in figure 1.2. Duchamp was aware of the Marey's stop-motion photography method, which he was particularly influenced by his *Woman Walking Downstairs* from his 1887 *The Human Figure in Motion* picture series. Marcel Duchamp talked about his *Nude Descending a Staircase* painting of how it connected to Futurism and the photographic motion studies of Muybridge and Marey:

"In 1912 ... the idea of describing the movement of a nude coming downstairs while still retaining static visual means to do this, particularly interested me. The fact that I had seen chronophotographs of fencers in action and horse galloping (what we today call stroboscopic photography) gave me the idea for the Nude. It doesn't mean that I copied these photographs. The Futurists were also interested in somewhat the same idea, though I was never a Futurist. And of course the motion picture with its cinematic techniques was developing then too. The whole idea of movement, of speed, was in the air."

Furthermore, Duchamp stated the following quote to supplement his idea behind his painting and its connection to motion,

"My aim was a static representation of movement, a static composition of indications of various positions taken by a form in movement—with no attempt to give cinema effects through painting. The reduction of a head in movement to a bare line seemed to me defensible."

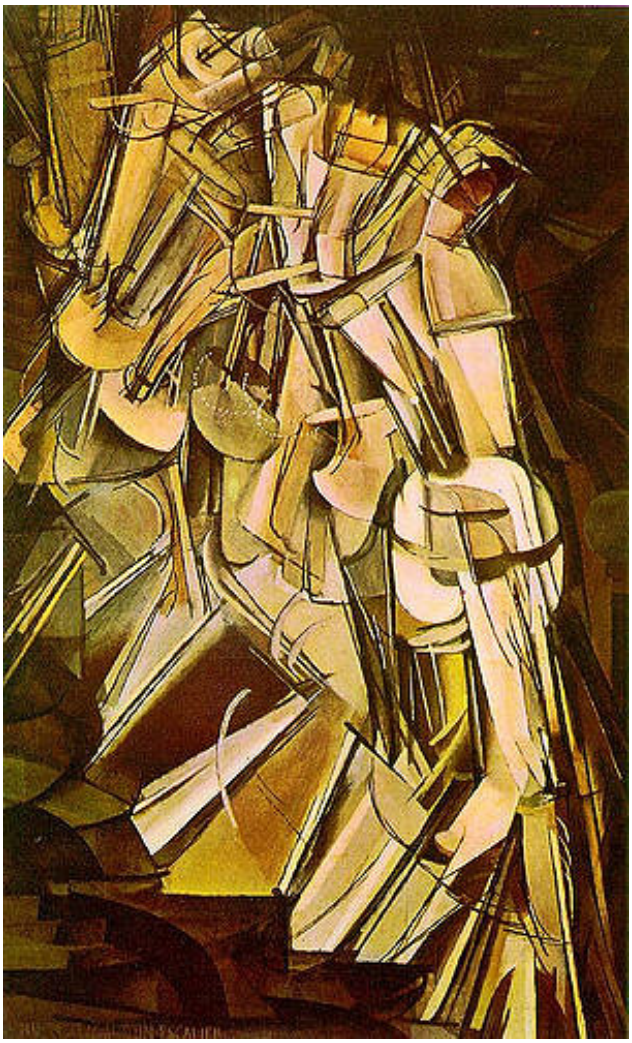

Figure 1. 5: Nude Descending a Staircase by Marcel Duchamp. (Source: http://4.bp.blogspot.com/-oaJDscBtNKk/UxHuberwTcI/AAAAAAAAhdk/f8SPqOghwfI/s1600/Nu_descendant_un_escalier_-_Marcel_Duchamp.jpg). Date accessed: March 22, 2016.

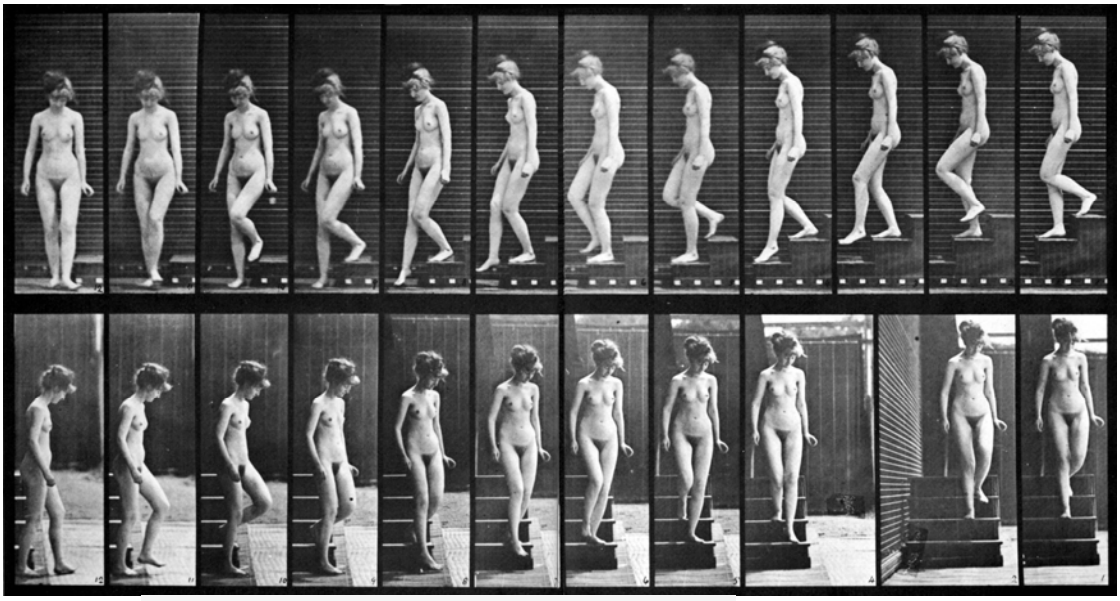

Figure 1. 6: Female nude motion study by Eadweard Muybridge. (Source: https://en.wikipedia.org/wiki/Nude_Descending_a_Staircase,_No._2#/media/File:Female_nude_motion_study_by_Eadweard_Muybridge_(2).jpg). Date accessed: September 26, 2016.

Animated Architecture

More recently, architect Greg Lynn, a maverick in the explorations of creating an architectural language, became a leader in the use of computer graphic software. For Lynn, a living architecture is about dynamism. Mark Rappolt, an editor of *ArtReview* and editor of Greg Lynn FORM, stated about Lynn,

> *"..Where most people's idea of architecture is about the static, the fixed, and the intert, Greg's work expresses dynamism, movement, and animation – both in a literal and a metaphorical sense*[5]*."*

Motion Capture Technology

In the twenty-first century, the boundaries of stop-motion method have been pushed to motion capture technology. Reminiscent of Marey's chronophotographic method, the development of this technology led to a new way of making films by

[5] Mark Rappolt, Greg Lynn FORM.

using human subjects with sensors attached to their bodies in order to trace every single body movement, as small as facial expressions.

It is from the works of Marey and Muybridge that I have been inspired to find ways to probe the promise of creative, dynamic architecture. When architecture is a translation of forms, by animating into walls, ceilings, and structures to name only a few, it can inspire activity, interaction and movement, as dance does.

Chapter 2: Methodologies of Showing Body Movement

Introduction

How do we dig deeper the potential of movement or what I wish to refer to as *dancing architecture*? In order to create *dancing architecture*, the first and foremost idea might be is how we can translate body movements of dance into forms and tectonics to what we might think of as animating the skin, muscles and bones of architecture.

Graphic Method

Studying the graphic method employed by Marey and Muybridge serves as a tool for this investigation. Following the footsteps of Marey, tracing out body movements of dancing will be vital in translating to architectural terms. Using this method allows the sequence of ephemeral dance movements to be seen and understood all at once, as seen in figure 2.1. Muybridge's graphic method of showing body movement is different than Marey's because rather than showing a chronology of movements, it shows the exact form of the body at a certain moment. A set of instantaneous photographs on the bottom of figure 2.1 is an example of this idea.

Motion Capture

Multi-instrumental music producer Maria Takeuchi and designer/director Frederico Phillips collaborated to create an experimental film, "Asphyxia", with dancer Shiho Tanaka as the subject. The purpose of the film was to explore expressive dance movements without bounds. Using inexpensive sensors of the Xbox

One Kinect video game system, they collected the scanned data and used various three-dimensional computer software as tools to further develop the piece with creativity.

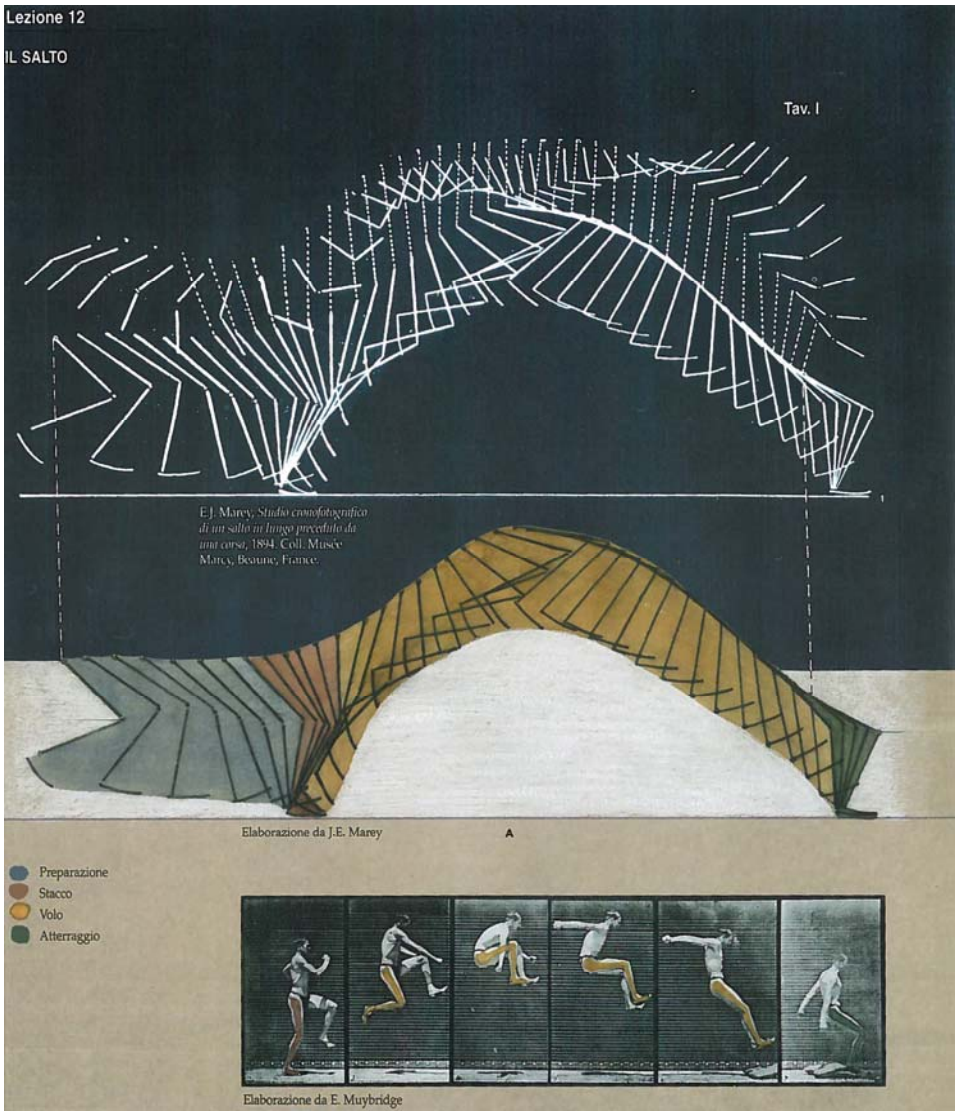

Figure 2. 1: Marey's graphic model of tracing a man jumping (top). Muybridge's stop motion photography of a man jumping (bottom). (Source: Struttura Uomo, Vol. 2)

Structurally Designing

When dance is looked at from the architectural perspective, it is a chain of structured, but related sequences, we see movement. Structured movement then, could be thought of as a translation of body movement into tectonic sequences and/or actions.

In Greg Lynn FORM, Lynn introduces *vivisection,* which Merriam-Webster defines as, "the cutting of or operation on a living animal usually for physiological or pathological investigation[6]." In terms of architecture, to *vivisect* an object means to cut it in parallel section planes. For Lynn, each plane is then supported by frames. The design of the Korean Presbyterian Church by Lynn in Long Island City, New York [*fig. 2.2*] is one of the best examples of *vivisection*.

My idea of *dancing architecture* will look into more deeply what Rappolt claimed about Lynn's methodology; to create a dynamic architecture that is a representation of body movements of dance in conjunction with the translation of dance with graphic methods, using those abstracted forms to visually conceptualize movement.

Figure 2. 2: Greg Lynn's Korean Presbyterian Church. (Source: Bob Trempe, Flickr). Date accessed: May 16, 2016.

[6] www.merriam-webster.com/dictionary/vivisection

Animation

Lynn uses 3D modeling programs because they help us see what he sees as its three fundamental properties: topology, time, and parameters, which are otherwise difficult to see with stationary mediums such as paper and pencil[7]. These principles are inferred to the temporal aspect that focuses on the process of how the form came to be instead of concentrating on the end product.

Ballet

For this thesis, a brief history and range of ballet types will be analyzed for its ability to help generate form. As there is history of using the human body, there is a history of how ballet evolved over time and for what purposes they serve.

Neoclassical Ballet

Neo-classical ballet was created by George Balanchine, a ballet choreographer who was deemed as the father of American ballet. Originally born and trained in Imperial Russia, Balanchine was a pioneer of the ballet tradition in that he abstained from the narrative classical ballet in favor of a radically modernist and "formalist" neoclassical style[8].

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[7] Greg Lynn, *Animate Form*. pp. 20

[8] Jennifer Homans, *Apollo's Angels: A History of Ballet*

Neoclassical ballet is known as the type of ballet that has no story line, but instead focuses more on the dance itself and how it is choreographed to the music. While still manipulating the structures of the classical form, there is increased speed, energy, and attack and has asymmetry.

Contemporary Ballet

Contemporary Ballet incorporates classical and modern dance. Just like neoclassical ballet, it roots from classical ballet techniques but has greater range of movement of the upper body. It is more flexible than classical ballet in that it is not constrained to keeping defined bodylines and forms.

Energetic Element of Dance

There may be different styles of ballet, but it is a fact that they all share the same characteristics: use of *body*, *action*, *space*, *time*, and *energy*. For my thesis, I want to focus on *energy*.

Energy defines the "how" aspect of dance. *Energy* itself has different characteristics and qualities shown in Table 2.1 and Table 2.2.

Energy:
Attack Sharp----------Smooth Sudden----------Sustained
Tension Tight----------Loose
Force Strong----------Gentle
Weight Heavy----------Light Strength: push, horizontal, impacted Lightness: resist the down, initiate up Resiliency: rebound, even up and down
Flow

Bound (Controlled)-----Free

Table 2. 1: Characteristics of Energy in Dance[9]

Energy Qualities:
Vigorous, languid, furious, melting, droopy, wild, lightly, jerkily, sneakily, timidly, proudly, sharp, smooth, sudden, sustained, collapsed, flowing, tight, loose, swinging, swaying, suspended, etc.

Table 2. 2: Qualities of Energy[10]

On top of all the aforementioned characteristics and qualities of energy, overall it comes down to two types of energy: potential energy, which is an energy that is stored right before that energy is spent, and kinetic energy, which is energy that is accelerated into motion.

[9] http://www.artsconnected.org/

[10] http://www.artsconnected.org/

Chapter 3: Analysis of Relevant Precedents

Stevie Eller Dance Theatre

The Stevie Eller Dance Theatre [*fig. 3.1*] in Tuscon, Arizona designed by Evan Gould, is one of the examples that support both Marey's and Lynn's methodologies. It shows Marey's methodology through an abstraction of movements that mirror a dancer going through each motion. The dance theater is a metaphorical representation of the ballet choreography "Serenade" by George Balanchine, who was an American ballet choreographer and a co-founder of the School of American Ballet and the New York City Ballet. The Gould Evans design team represented Balanchine's choreography by studying *labanotation,* which is a system of graphic representation of dance through notation. The building seen as a whole is an amalgamation of the choreography that cannot otherwise be seen during an actual performance.

The dance center reflects Lynn's methodology through the use of tectonics. The Gould Evans design team analyzed *labanotation* and the score for "Serenade". Then they overlaid the starting positions for each movement to create a matrix which produced a grid of tilted columns that support the dance studio above[11]. For this project, designers and dancers collaborated; dancers taught the designers about dance while the designers taught dancers about structure. Together they created dancing columns.

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[11] Gould Evans, *Live Learn Work Play*.

Figure 3. 1: Stevie Eller Dance Theater by Gould Evans. (Source: Gene Spesard, Flickr). Date accessed: March 23, 2016.

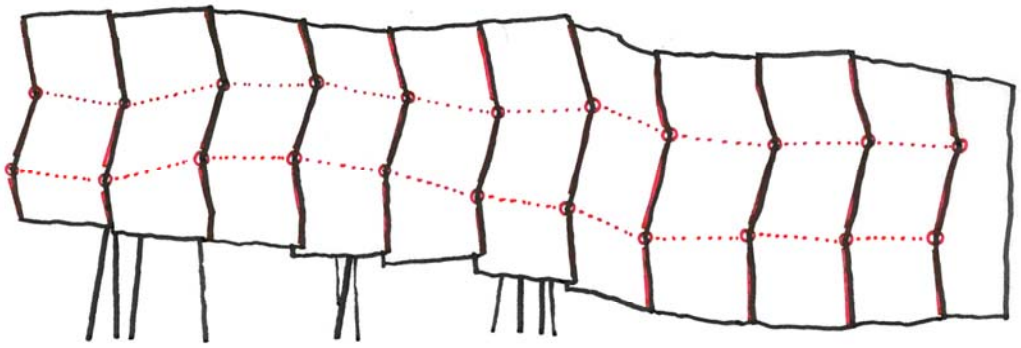

Figure 3. 2: Graphic notation of the dance theater (source: author)

From this precedent study I deduced how I would go about designing the façade of my thesis project. If the façade is the representation of the whole building, then I need to find a type of movement I want to convey metaphorically to the public.

In the case of the Stevie Eller Dance Theater, the goal of the designers was to express movement, which is the central focus of the learning environment. The metaphorical façade acts as a protective scrim of the dance studio.

In terms of space, the designers designated volumes in such a way that they transform into another space. For example, the auditorium in the Stevie Eller Dance Theater is a volume that rolls and moves to become and exterior surface that acts as a protection of the glazing of the dance studio. The designers investigated how inside volumes become outside surfaces through typology and also proposed a three-dimensional Mobius strip idea. This was the driving force of the design of the interior and exterior of the building.

Korean Presbyterian Church

The Korean Presbyterian Church [*fig. 2.2*] was once Knickerbocker Laundry factory around the 1930's. With adaptive reuse, Greg Lynn and other design teams turned the factory building into a church and community center for the congregation of Korean Americans. A composite structure between the existing building and the new space for assembly was necessary. The newly constructed sanctuary is a space of interest, which Lynn explains as, "composed of a folded and shredded interior to a new north/south structural grid.[12]" He further noted,

> "*These surfaces torque in such a way that from the congregation's seats, looking toward the altar, the interior facets overlap to form a closed surface with light coming from the hidden bands between bays. At the entries and exterior stair these surfaces open to give views between their aps oriented toward the Manhattan skyline and into the interior lobby and entry stair. The entries, stairs, circulation and lobbies are located in undulating tubular*

[12] Greg Lynn, Greg Lynn FORM.

volumes that thread through the existing structure with stairs, ramps, and linear lobby spaces.[13]"

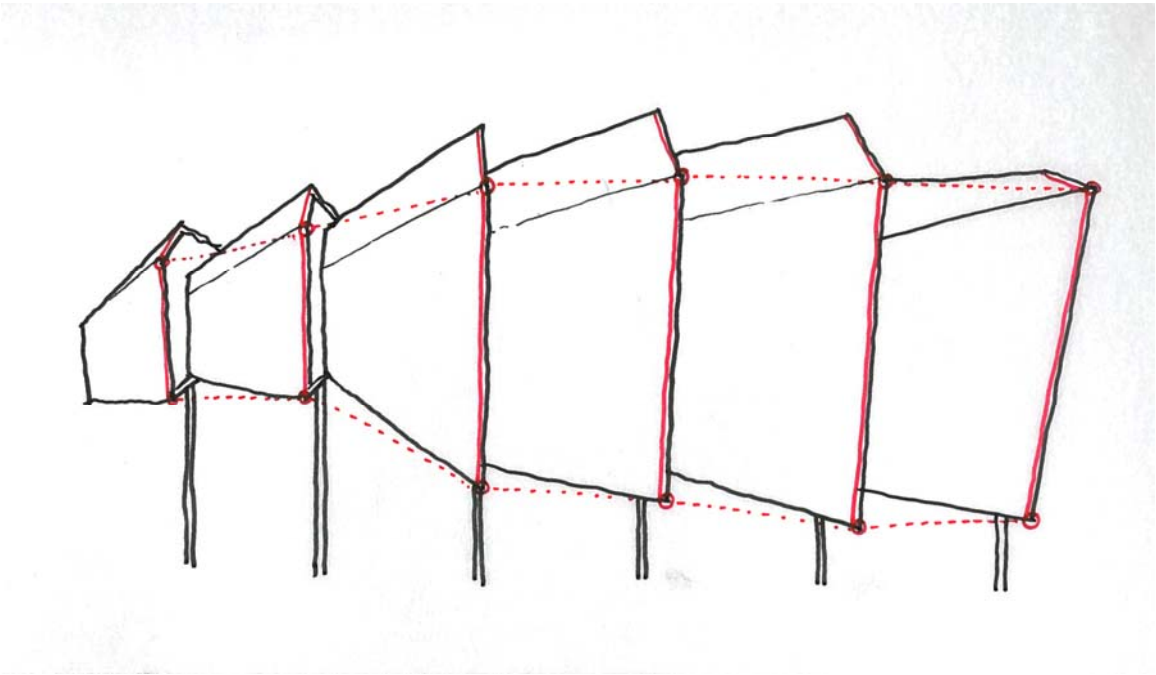

Figure 3. 3: Graphic notation of the church (source: author)

Diamond Ranch High School

Introduction

Diamond Ranch High School is located in Pomona, California, designed by the firm Morphosis [*fig. 3.4*]. This precedent is being studied because of its program, treatment of the site and its design intentions.

[13] Greg Lynn, Greg Lynn FORM.

Goal

The goal of Morphosis was to experientially engage architecture and education together by using a physically kinetic architectural language in order to induce inquiry and curiosity[14]. This idea is in line with the thesis's concentration on translating dance movements as a didactic narrative to evoke the desire to learn and experience the architecture. On its campus, there are two rows of building clusters that face each other along a central street. This central street provides the primary opportunity for students to interact with one another and with teachers and administrators as they move about the campus[15]. Although not taken from dance forms, both sides are arranged in a way that is reminiscent of two people interacting in a sequential movement when seen from the dance perspective.

Site

The site is located in an area with a steeply sloped site that was seen as an opportunity to dictate the language of the buildings. Accordingly, it is a land-form project that abandons the notion that architecture is solely an object. This idea could be applied to the thesis in terms of how the landscape would generate the interaction that it makes with the architecture, instead of acting as two separate entities. Jeffrey Kipnis, an architectural critic who had a conversation with Thom Mayne of Morphosis about land-form projects, made an analogy that the land in which the school is situated on is

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[14] http://www.morphosis.com/architecture/14/
[15] http://www.morphosis.com/architecture/14/

akin to the water in the ocean that holds incongruent elements in a coherent spatial system. Thom Mayne agreed with Kipnis's statement, in which he claimed that the land at Diamond Ranch High School does indeed act much like the water in Kipnis's analogy.

Programs

The most intriguing arrangement of programs are the classrooms and courtyards. A long, linear corridor threads three groups of classrooms with each its own courtyard (figure #). The curvilinear shape of the courtyards recall

Figure 3. 4: View of Diamond Ranch High School. (Source: informedmindstravel, Flickr). Date accessed: May 16, 2016.

Tianjin Elementary School

Introduction

Tianjin Elementary School, by Vector Architects and CCDI, is located in Tianjin, China [*fig. 3.5*]. With an area of 180,000 square meters, this project was done in 2010 by the request of the county government. This precedent is being studied for its arrangement of programs.

Goals

Vector Architects and CCDI's goal for this project was to establish a unique place within the school that encourages interaction between the students and teachers through their daily learning and teaching life. The programs include 48 classrooms, a number of special program classrooms, cafeteria, training gymnasium, administration areas and an outdoor exercise field.

The architects started their design process with an analytical research of the spatial pattern of interactive activities, both in plan and section. The best location of the primary interactive space is on the 2nd floor, sandwiched by regular classroom floors, and connected to the skylight through the central atrium, where natural ventilation were maximized[16].

[16] http://www.archdaily.com/79227/tianjin-elementary-school-vector-architects-ccdi

Chapter 4: Program and Site

Since my thesis is more driven by form studies, I first found an example of a contemporary ballet piece called “Tides” by Christopher Wheeldon that I could deconstruct before I conceived my conceptual diagrams for a school. I took screenshots of a dancer doing a pirouette [*fig 4.1*], traced each instantaneous movement in a 3-D software [*fig 4.2*] and then connected them to derive some patterns of energy.

Figure 4. 1: Screenshots of Christopher Wheeldon’s contemporary ballet piece, “Tides” (source: author)

Figure 4. 2: Traces of each movement (source: author)

Here I noticed more types of energy [*fig 4.3*]. The dark blue portion shows sustained energy, the moment before the dancer releases his/her energy. The light blue portion shows kinetic movement that is flowing, and the orange shows kinetic movement that is vigorous.

Using these characteristics, I conceived conceptual diagrams of the buildings on both sites to look at how movement of people could be manipulated. Architecturally, the dark blue portion could be thresholds, light blue portion as a promenade, and the orange portion as a program such as the workshop space.

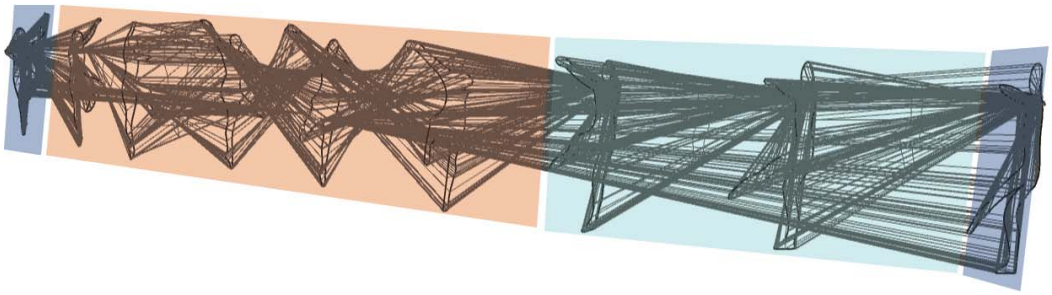

Figure 4. 3: Types of energy in "Tides" (source: author)

Program

I have chosen the program of my thesis to be an elementary school. This will lead to an exploration of how dance forms might inspire the interactions of students and teachers. Using the lessons from dance for a more didactic architecture, a place that encourages experiential learning. It will also be a place where students and teachers will learn how to perform experience through instilling movement.

Programmatic Elements in the School

Classrooms

Since the goal is to encourage interaction within an experiential architecture, the arrangement of classrooms as dance forms so that they compel movement and interaction. Instead of crowding a group of classrooms in a static manner, learning environment will be more experiential if spaces for classrooms are dynamic.

Promenade

A street that provides the main structure for movement the length of the school could weave the different programs within the school is a potential dynamism for study and cultural leaving. Another opportunity for designing the promenade could be a bridge that connects programs that are separated.

Playground

Incorporating the larger landscape and its interaction with the school could also be taken into consideration as experiential architecture.

Maker Space

Maker spaces are workshop spaces with movable furniture that serve as a place for people to learn through doing/making. Adding in a maker space is considered for this thesis to encourage the idea of physical movement within the school, which is a different approach to learning as opposed to merely sitting down in chairs throughout the day. This supports the idea of learning through doing.

Site considerations

Site factors that are considered for this thesis are:

1.) Immersed in urban fabric, especially one that lacks a school or a community center

If the proposed elementary school were to be placed in the middle of an urban fabric that currently lacks of such program as an object, it would be an opportunity to bring awareness to the effect of experiential architecture.

2.) Site in which existing buildings could be considered for interaction with the thesis

Existing buildings serve as an opportunity to create contextual architecture that interacts with other buildings as a riddle that can be passed off to each other.

3.) Site with opportunistic topographical features that supplement the thesis

Taking the Diamond Ranch High School as an example, a site with unique topographical conditions would be integrated as part of the experiential design in which people experience both landscape and architecture.

Site 1: Hyde-Addison Elementary School

The Hyde-Addison Elementary School site is located in Georgetown, Washington, D.C. Currently two separate buildings, Hyde and Addison, exist [*fig 4.4*].

Figure 4. 4: Hyde-Addison Site map (source: author)

The Hyde building, named after a businessman named Anthony Hyde, was designed by architect Arthur B. Heaton and built in 1907. The Hyde building alone was not sufficient for Georgetown's school population; therefore, following the construction of Hyde, the Addison School was built right next to it. Along with the addition of the Addison School, the Curtis School was built but was demolished in 1951.

Although the Hyde-Addison Elementary School is a united school, the children are separated by their grades. The youngest grades are located in the Hyde building while the higher grades are located in the Addison building. These two

buildings are merely joined on the ground by an asphalt play court. The disconnection between these buildings are evident in section [*fig 4.5*].

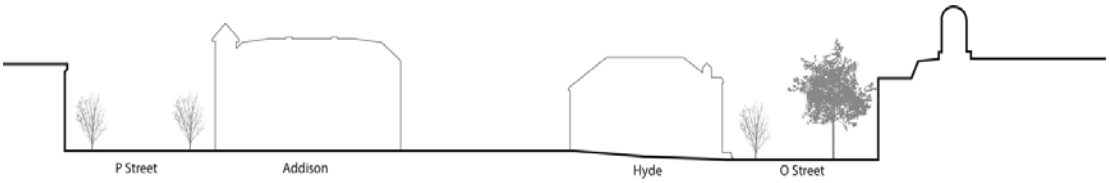

Figure 4. 5: Section cutting through Addison and Hyde (source: author)

Despite the disconnection that exists for the school, this serves as an opportunity to connect and unite them with a design intervention. This link, which is essentially a mediator, would encourage more collaboration between the youngest and higher grades and teachers. Figure 4.6 is a parti diagram that shows the possibility of adding in programs within the link. Figure 4.7 shows different ways that this link could be conceived by translating the energetic characteristics of ballet, as done for the "Tides" ballet piece.

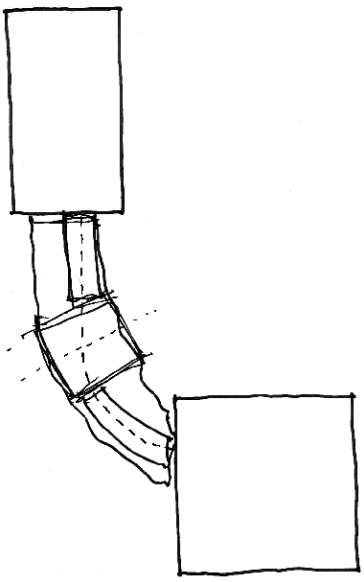

Figure 4. 6: Parti diagram of link between Addison and Hyde (source: author)

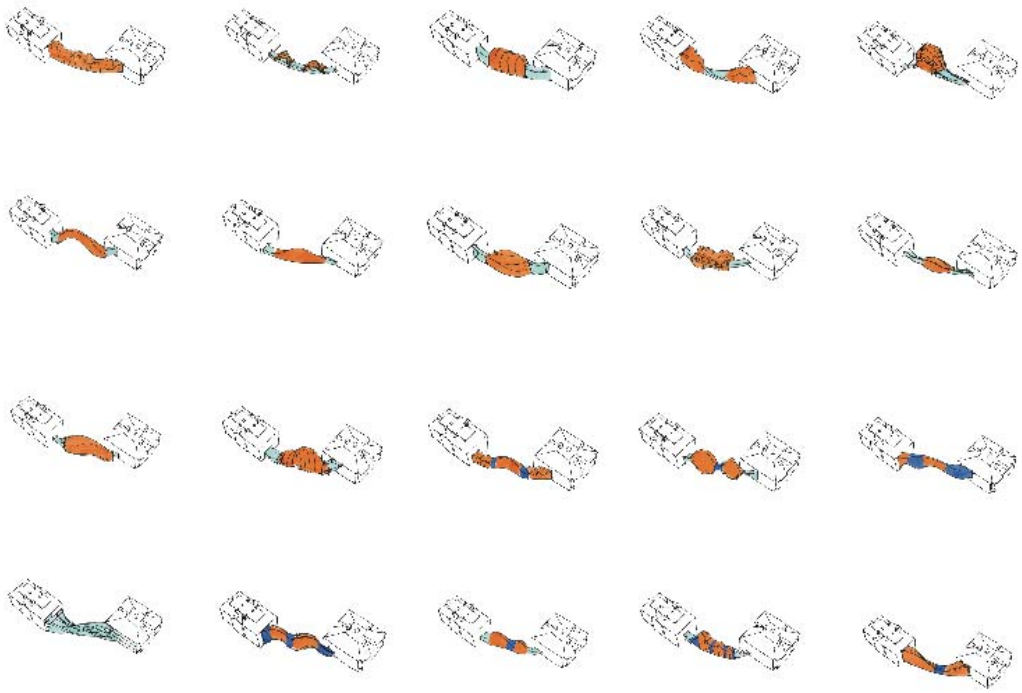

Figure 4. 7: Diagrams of links between Addison and Hyde (source: author)

Marie Reed Elementary School

Marie Reed Elementary School, opened in 1977, is located in Adams Morgan, Washington, D.C. While it is an elementary school, it is also a community-learning center. It contains a public health clinic, childcare center, adult education, swimming pool and turf field. Currently, there are plans for the modernization of Marie Reed to either build a new school to provide the needs of the community and its students, or carry out a renovation.

The intriguing factor about this site was the flanking buildings on either side of Champlain Street, allowing the street to run beneath the middle of the building [*fig 4.8]*. The section of this building [*fig 4.9*] shows that both cars and pedestrians are able to pass beneath this space.

This street is an opportunity to create an internal street inside the building for pedestrians. Another opportunity would be to create a stronger connection or a shared space between the two flanking buildings. Figure 4.10 is a collection of diagrams that explains how these buildings could connect, using the same method for “Tides”.

Figure 4. 8: Marie Reed Elementary School site map (source: author)

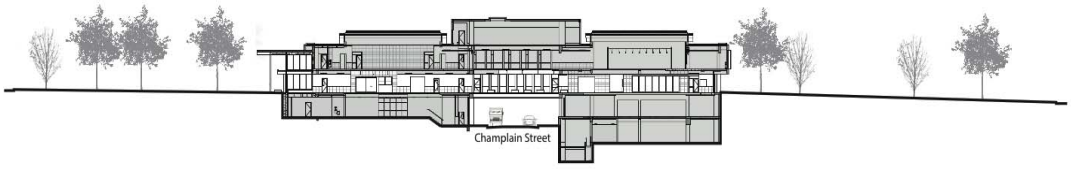

Figure 4. 9: Section cutting through school and Champlain St. (source: author)

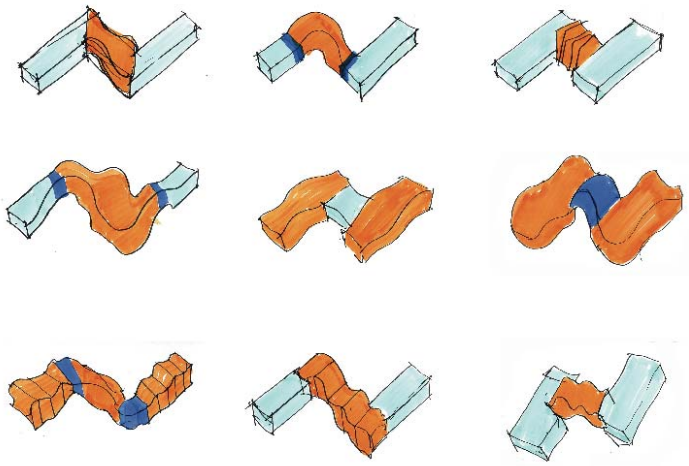

Figure 4. 10: Diagrams of how buildings could be connected (source: author)

Chapter 5: Issues with Current Site

Static Architecture, Static School

Site Selection

For my thesis, I have decided on the Hyde-Addison Elementary School as my site. After a visit and tour of the site, I was even more convinced that the Hyde-Addison Elementary School was a good decision.

I learned a more accurate history of how Hyde-Addison came to be a school. The Addison building was the first to be built, but was a mental institution before it turned into a school. Shortly after, Hyde was built and became a unified school. Addison was remodeled in 2008 and Hyde was remodeled in 2014.

Currently there are 330 students enrolled at Hyde-Addison, which is undersized. In D.C., there needs to be at least 400 students in order to be fully funded. As a consequence, the position of assistant principal is not fulfilled and a partnership with the Fillmore Art School is necessary in order to compensate for the inadequate funding per each student.

Difficulties of the Site

The biggest problem of the site is the separation of the Hyde and Addison buildings. The students and faculties go back and forth between the buildings all day, even when it's raining or snowing during a blistering cold weather. There is no protection that offers them security nor comfort.

The parking situation is causing some frustrations. After all, Hyde-Addison is a school in the urban Georgetown, so there are only 31 parking spots. Although this is

more than the average parking spots for urban schools, it certainly is not enough for all faculty members. Furthermore, it is a one-way circulation that starts from the P Street and exits to the O Street (figure 5.1), which poses a problem when delivery trucks are parked and block other cars. The inadequacy and narrowness of the parking lot is evident in the photo (figure 5.2).

Figure 5. 1: Existing site plan (source: author)

School buses serve the school. They drop the kids off and also pick them up along O Street, which has to have the curbs blocked off with cones by a security guard for bus space. This must be done on both mornings and afternoons every school day, and also every mid-day on Wednesdays to take the kids to the Fillmore Art School.

As a result of the separation of buildings, the programs are dissociated. The cafeteria is located only in the Addison. In order for students in the Hyde to have lunch, they must walk outside to go inside Addison.

Figure 5. 2: View of the Hyde-Addison parking lot (source: author)

Lack of Programs and Space

Currently, a gymnasium does not exist, but instead the play court (figure 5.3) serves as a gym for physical education. The problem with this is that the play court is located outside, so when there is inclement weather, the students are forced to go down into the lobby in the basement of Hyde (figure 5.4) of approximately 550 square feet, which is not practical at all for a physical education class.

Another program that does not serve enough space is the cafeteria, also used as a multi-purpose room. Because only a maximum of 100 students can fit at a time with lunch tables spread out, there are 4 lunch periods. Without lunch tables, 150 people could fit, but still not spacious enough to be used for other activities. In

addition, the kitchen, instead of being naturally connected to the cafeteria, is lodged into the opposite corner of Addison.

Figure 5. 3: View of the Hyde-Addison playcourt from O St. (source: author)

Figure 5. 4: View of the basement level in Hyde (source: author)

Chapter 6: Design Intentions

The biggest issue that I saw within the Hyde-Addison Elementary School site is the lack of connection. The gaping space between the two buildings is causing a lot of discomfort, inconvenience, and disconnect for everyone. The first approach I took to think about the design of Hyde-Addison was asking myself, "How do I create a dynamic yet functional connection between Hyde and Addison?" Dance deals with movement and transition through space and between poses. Therefore, this connection can take cues from dance to create a dynamic connection. I began to think about how the spatial configurations between Hyde and Addison could be arranged so that overlapping spaces and connections could exist in the new design. Figure 6.2 shows a basic diagram of the potential overlapping space shown as orange, and the extension shown in grey.

Facades

As of now, the main façade of the school would be the entrance face of Hyde along O Street. By extending both buildings and adding the overlapping space, opportunities for new facades open up, as shown in figure 6.3. All three facades will be a transition of motion from the old building to the new proposed building, or from point A to point B in terms of describing motion.

Figure 6. 1: Land uses (source: author)

Figure 6. 2: Idea of overlapping space (source: author)

Land Uses

Hyde-Addison Elementary School is surrounded by residential homes, predominantly to the west shown in yellow and retail spaces to the east in red (figure 6.1).

Entries

Currently, the only entrance to the school is to the Hyde building along O Street. In figure 6.4, the red arrows indicate new possible pedestrian entrances and the red circles indicate new possible building entrances. For my thesis I plan to appoint a new building entrance through a new façade.

Massing Studies

After exploring the possibilities of the site, I conducted massing studies to investigate different connections between Hyde and Addison. For each diagram, I thought about which parts should be extended (grey), where the overlapping space should be, and defined circulation and connection (blue) for some diagrams.

Figure 6. 3: View of the Hyde-Addison parking lot (source: author

Figure 6. 4: Entrances (source: author)

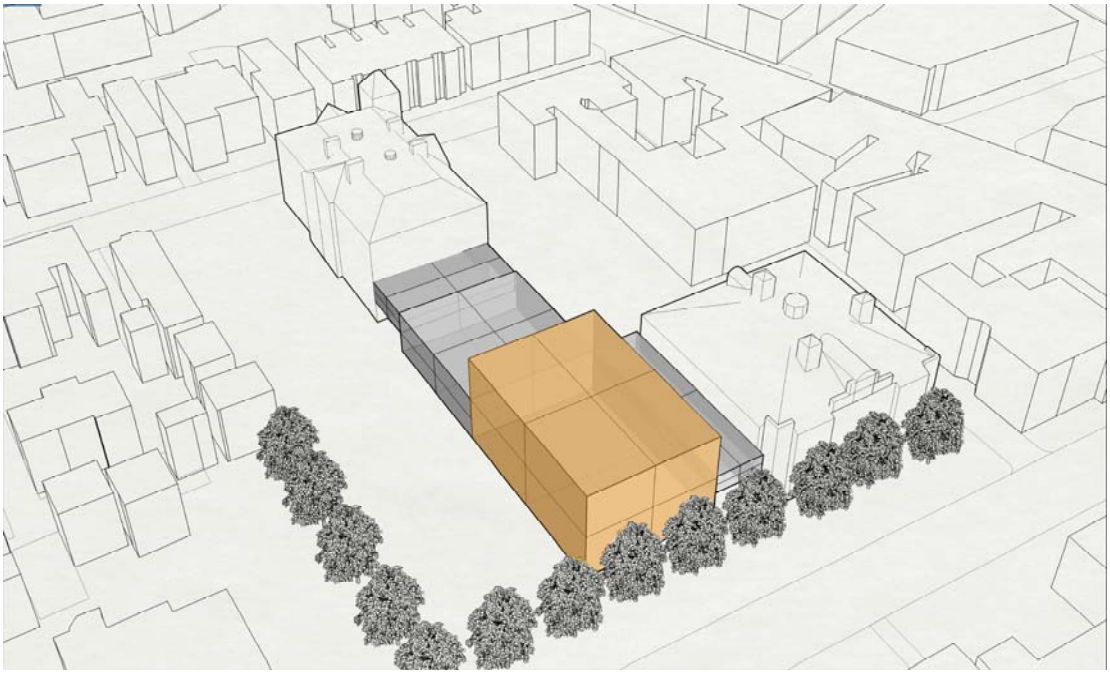

Figure 6. 5: Massing study number 1 (source: author)

Figure 6.5 is massing study number one. This is a basic way of extending the buildings and eventually meeting to a point of overlap of activities in the orange mass. Pass-throughs are incorporated in order to suggest the idea of letting people through the building so that they can access all parts of the site with ease. Pedestrians would enter through the plaza in front of the Addison and the proposed building's facades and enter at the end of the plaza through the orange mass. In this case then, the parking situation would remain the same.

Figure 6.6, massing study number five, is a different situation where the existing playground has been changed to a parking lot in order to offer more parking space. Because this takes up considerable space to place programs, this made me think of adding a raised overlapping space (orange mass) and possible a raised playground. The blue mass in this diagram shows a two level connection from Hyde which turns into a single level connector to the extension of Addison. It also acts as a

gasket between Hyde and the orange mass, and also between the orange mass and Addison's extension.

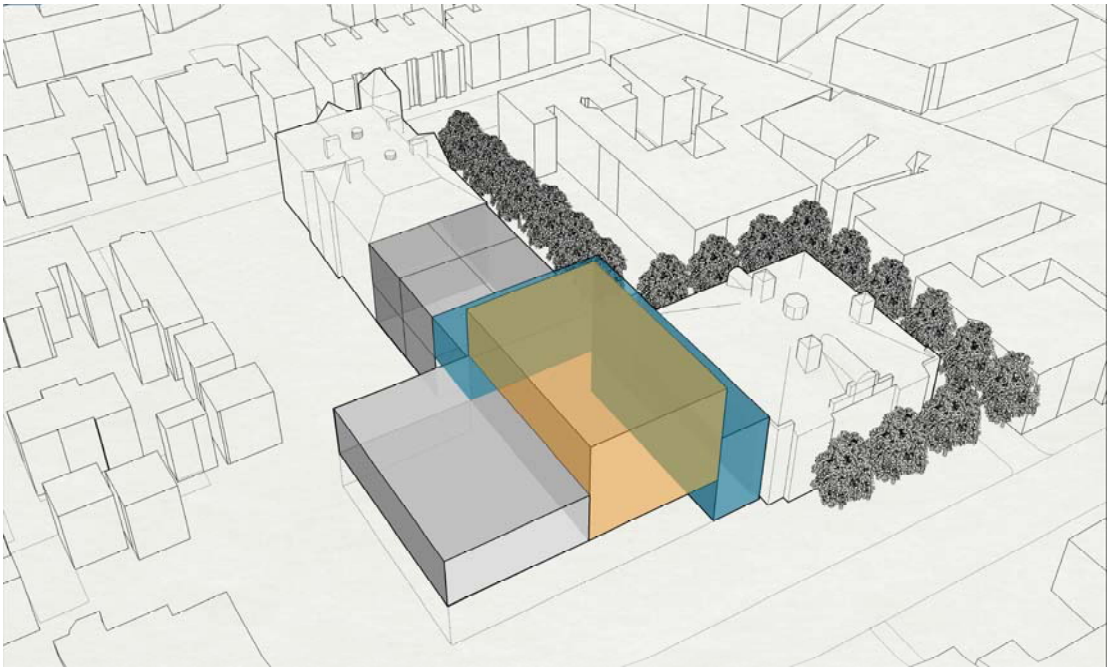

Figure 6. 6: Massing study number 5 (source: author)

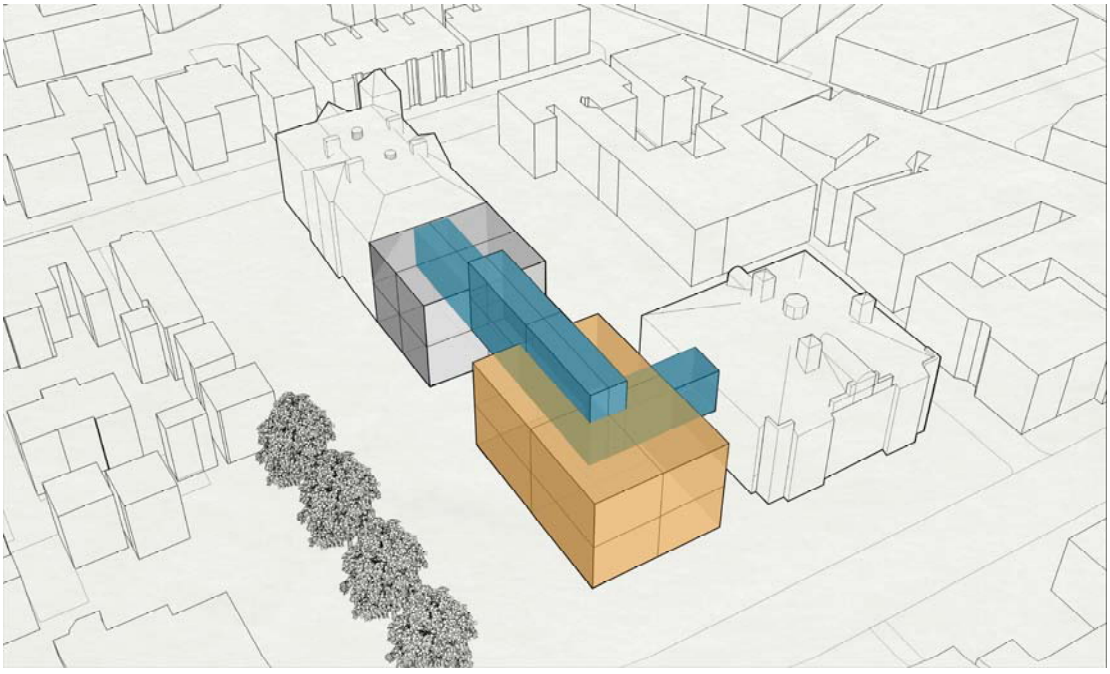

Figure 6. 7: Massing study number 7 (source: author)

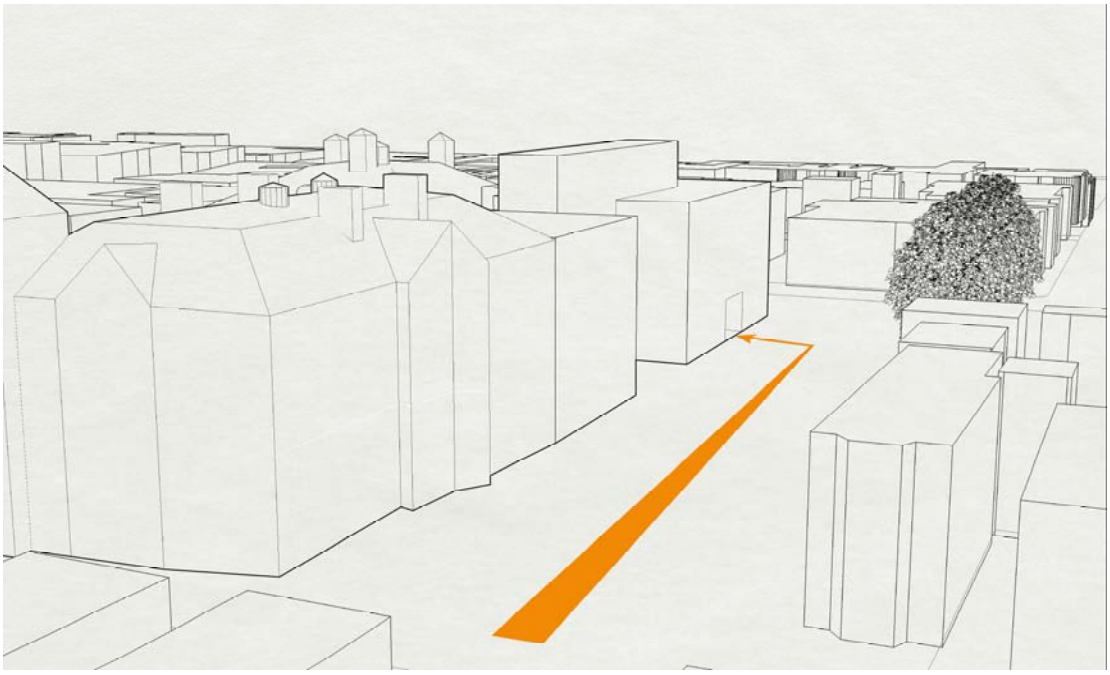

Figure 6. 8: Plaza and entrance (source: author)

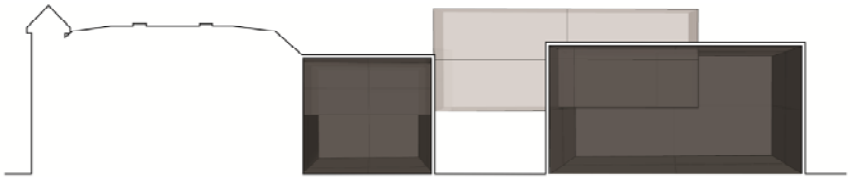

Figure 6. 9: Section showing movement and transition (source: author)

Figure 6.6 is massing study number seven which I was learning towards. The most interesting factor to me about this diagram is that the raised blue massing allows two pass-throughs and suggests more of the idea of a gasket rather than butting it up against the old buildings. The parking area will remain the same while pedestrians will enter from P Street, walk along the new plaza in front of the Addison and enter at the new building at the end of the plaza (figure 6.8). The section shows different experiences while moving/transitioning between the buildings (figure 6.9).

Chapter 7: Multiple Intelligences Theory

I was fortunate to have come across Fielding Nair Architects' work and their expertise on designing schools. Their empathic focus on children and their different ways of learning helped me appoint what kind of programs I should have in my building. They referred to Howard Gardner's (developmental psychologist) theory or multiple intelligences and how certain school spaces enhance these intelligences (figure 7.2). Most schools today unfortunately follow the Henry Ford factory production model (figure 7.1), where a row of rectilinear classrooms flank a long and skinny corridor[17].

By investigating the multiple intelligences chart, I have tried to incorporate programs that support bodily-kinesthetic intelligence since my thesis is focused on movement and dance, and also support other intelligences. I have chosen advisory grouping, cave space, amphitheater, watering hole space, performance space, outdoor learning terrace and entrance for my building.

[17] The Language of School Design, Fielding Nair

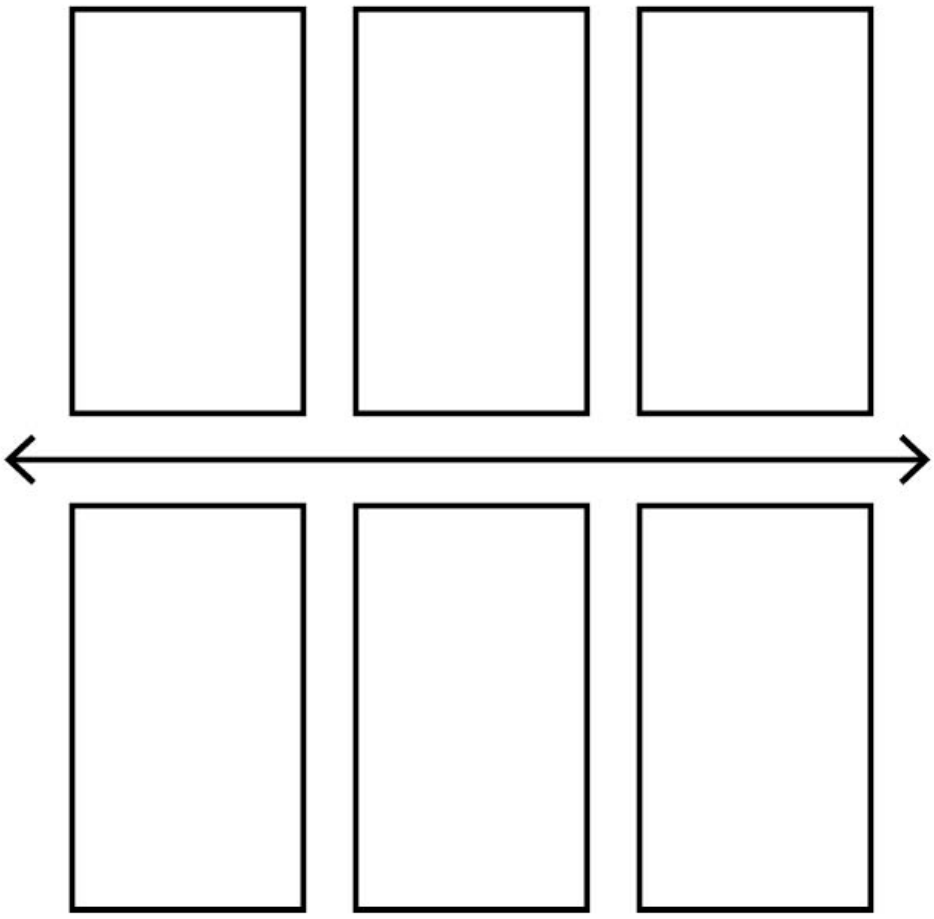

Figure 7. 1: Henry Ford's factory production method (source: author)

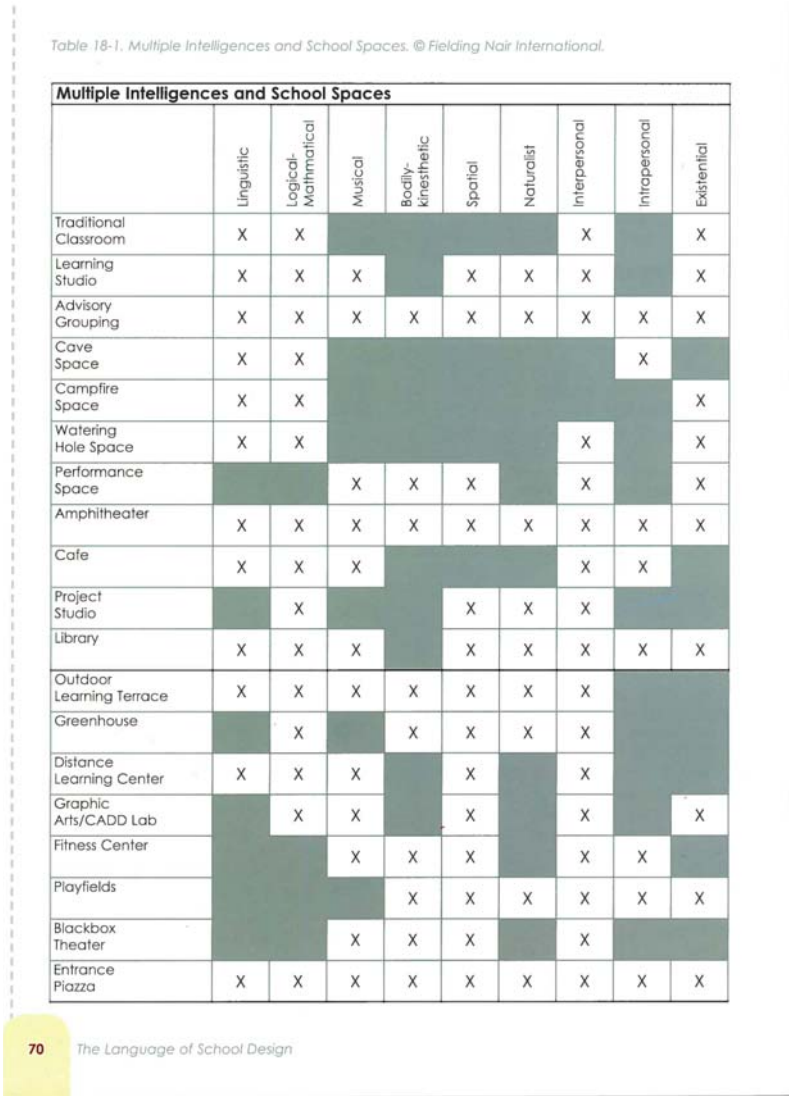

Table 18-1. Multiple Intelligences and School Spaces. © Fielding Nair International.

Multiple Intelligences and School Spaces	Linguistic	Logical-Mathmatical	Musical	Bodily-kinesthetic	Spatial	Naturalist	Interpersonal	Intrapersonal	Existential
Traditional Classroom	X	X					X		X
Learning Studio	X	X	X		X	X	X		X
Advisory Grouping	X	X	X	X	X	X	X	X	X
Cave Space	X	X						X	
Campfire Space	X	X							X
Watering Hole Space	X	X					X		X
Performance Space			X	X	X		X		X
Amphitheater	X	X	X	X	X	X	X	X	X
Cafe	X	X	X				X	X	
Project Studio		X			X	X	X		
Library	X	X	X		X	X	X	X	X
Outdoor Learning Terrace	X	X	X	X	X	X	X		
Greenhouse		X		X	X	X	X		
Distance Learning Center	X	X	X		X		X		
Graphic Arts/CADD Lab		X	X		X		X		X
Fitness Center			X	X	X		X	X	
Playfields				X	X	X	X	X	X
Blackbox Theater			X	X	X		X		
Entrance Piazza	X	X	X	X	X	X	X	X	X

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Figure 7. 2: Multiple intelligences and school spaces chart (The Language of School Design, Fielding Nair, pg. 70)

Chapter 8: Final Design

Design Inspiration

The main catalyst to the design of my building was architect Andrea Ponsi's "A Short Discourse on the Long Line" lecture. As he was showing his simple yet powerful line drawings on the projector, a light bulb went on in my head about my own design, after a long struggle of resolving the parti of my building. I realized that Ponsi was not trying to be accurate in his representations, but painting his own visions and interpretations. This propelled me to use and think of the *pirouette,* an act of spinning on one foot while the other leg is raised to the knee of the turning leg, in a completely different way. I envisioned the *pirouette* as a fluid motion that would tie everything together vertically and horizontally within my building.

Using both Marey and Muybridge's motion capture method and Ponsi's idea of the long line (figure 8.21), I was able to discover two major forms. Figure 8.1 shows the form made from tracing the lines of the dancers arms in a pirouette. A unique characteristic of this form was a void in the middle, which gave me ideas of incorporating an oculus within my building. The other form (figure 8.2) was generated from tracing the dancer's leg about a vertical axis of her supporting leg, the leg that is the turning axis. Putting these two forms together aided me in realizing that the oculus, when superimposed on the vertical axis of the leg form, produces a new center of gravity for the building.

Figure 8. 1: Oculus form made from dancer's arms (source: author)

Figure 8. 2: Form made from dancer's leg (source: author)

Final Design Moves

The Oculus

The section (figure 8.3) shows the oculus puncturing through all levels of the new addition, specifically the informal gathering programs that are the watering hole on the second level, the amphitheater space on the ground level, and the performance space on the lower level. Just as the dancer is turning on one leg as the vertical axis, the oculus too has a vertical axis that is not physically accessed, but accessed by the

sunlight that penetrates through the skylight above, bringing light all the way down into the performance area. The oculus is transparent throughout all levels in order to be visible from any angle. It serves as a way finder to guide people to go to any part of the school, whether it is the new addition or the existing buildings.

Hyde-Addison currently lacks a strong entrance that sets a real presence for the school. Setting the new addition the new entrance would develop a sense of identity. The new entrance brings people into the interstitial space between the new addition and the Hyde building (figure 8.4).

Ground Level

Upon entering the school, people are greeted by the oculus (figure 8.10). They are given a choice to either venture throughout the ground level, go spiraling up into the oculus, or go up to the ramp that leads to the Hyde building to the right (figure 8.5). On this level, an amphitheater surrounds a part of the oculus, where students can sit and listen to speakers (figure 8.9). Further in the back, getting closer to the Addison building, people come across a casual eating area that replaces the old cafeteria in the Addison (figure 8.13). The space is more open, bright, and contains soft seating to make lunch time for enjoyable and relaxing for students. To the left are stairs that lead downwards into the lower level.

Lower Level

A unique characteristic of the lower level is the continuation of the oculus (figure 8.6). People would be able to see the stream of light coming through, lighting up the

floor with oblong patterns that mimic the oblong shape of the whole space. The lower level is versatile in terms of use. When used as a performance space (figure 8.11), the performer(s) would be right underneath the oculus, performing while being bathed in light as the audience surrounds the center. The lower level could also be used as a gymnasium or a dance studio. The large open space encourages users to freely move around.

Second Level

The second level is accessed by going upwards into the oculus from the ground level, or by the newly created elevator within the Hyde building (figure 8.7). The spiral stairs have been placed within the oculus to really embody the existence of the oculus. As people go up or down these stairs, they would experience a sense of adventure, mysteriousness and curiosity, wondering where the oculus would lead them. On this level, the watering hole area surrounds the oculus. There is space for advisory grouping and also small cave spaces along the west façade that are enclosed within undulating walls for students that learn better individually (figure 8.12). These programs flank a ramp that leads and penetrates into the Addison. When students need a mental break from learning, they are allowed to relax in a breakout area that is right above the amphitheater (figure 8.14). The floor is open to below, allowing anyone to see what is going on in the amphitheater. There is also a balcony that allows teachers to have breaks themselves.

Roof Level

Going further up into the oculus allows people to access the green roof (figure 8.8). The undulation of the roof can be experienced on this level, encouraging students to run around, explore, and to be even more active outside of classrooms. There is a stage on the roof for outdoor performances, and the seating is catered by the slope of the roof line (figure 8.15).

Building Skin

In order to design the skin of the building, I looked at the anatomy of the ballet *tutu*. Just as a dancer wears a tutu for her performance, the new addition would be adorned with an exterior that would be symbolic of movement.

After analyzing the classical *tutu* for its structural intricacies (figure 8.16), I have realized that the tutu was constructed from many different parts that I was able to extract. I decided that the most conspicuous and important parts that make the tutu are the *bodice*, *basque*, and the *skirt*. From these elements I concocted a wall system (figure 8.19).

The *bodice* is a corset-like jacket that covers the torso of the dancer, made up of many panels that are seamed together. I translated this as solid wall panels with occasional glass panels. Figure 8.17 shows one set of panels that I created and turned this into a series of panels as a tessellation pattern (figure 8.18).

The *basque* is an extension of the bodice that goes past the waistline. This is attached to the *bodice,* which I translated as an extension for another layer in front of the solid wall panels.

The classical *skirt* is made up of many layers of tulle. Because of tulle's net-like quality, this gave me an idea of installing an architectural mesh that is attached to the solid wall panels by connectors, which are attached to the mullions of glass windows.

Building Structure

For my building structure (figure 8.20), I decided to incorporate a space truss to accommodate the undulation of the roof, which would transfer its loads onto mullions and solid bearing walls. These then would transfer their loads onto a series of steel beams and columns down below. A steel compression ring was added to accommodate the shape of the oculus.

Conclusion

By envisioning a pirouette as a design catalyst for the building, I attempted to give both existing buildings a dance partner in terms of dance. With the new addition, people are able to move liberally, dancing from the old to new and vice versa. I believe that by promoting movement in the building, this would engender more interaction between teachers and students with programs that allow them to do more than just sit in classrooms. I also believe that by incorporating the idea of dance, it offers unique and various spaces that most of us were not able to experience as students, and hope that there is more empathy towards children who learn differently.

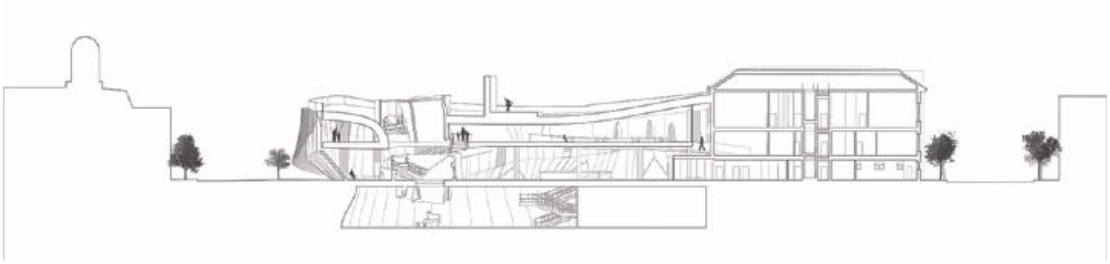

Figure 8. 3: Longitudinal section through new addition and Addison (source: author)

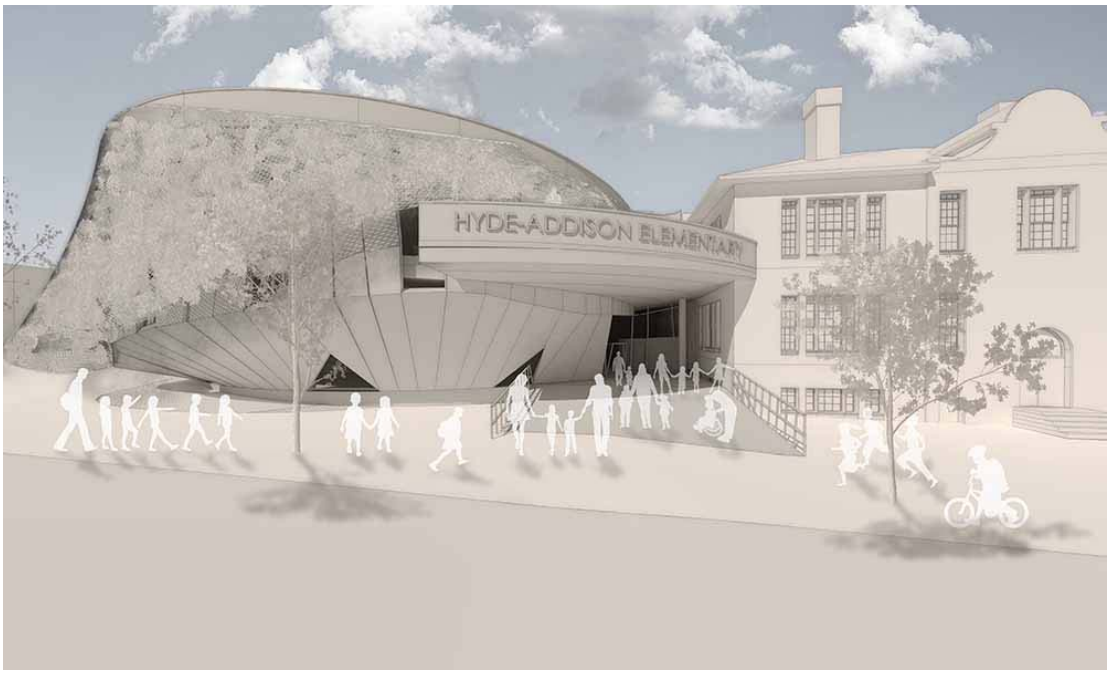

Figure 8. 4: Exterior view of the new addition and Hyde buildings (source: author)

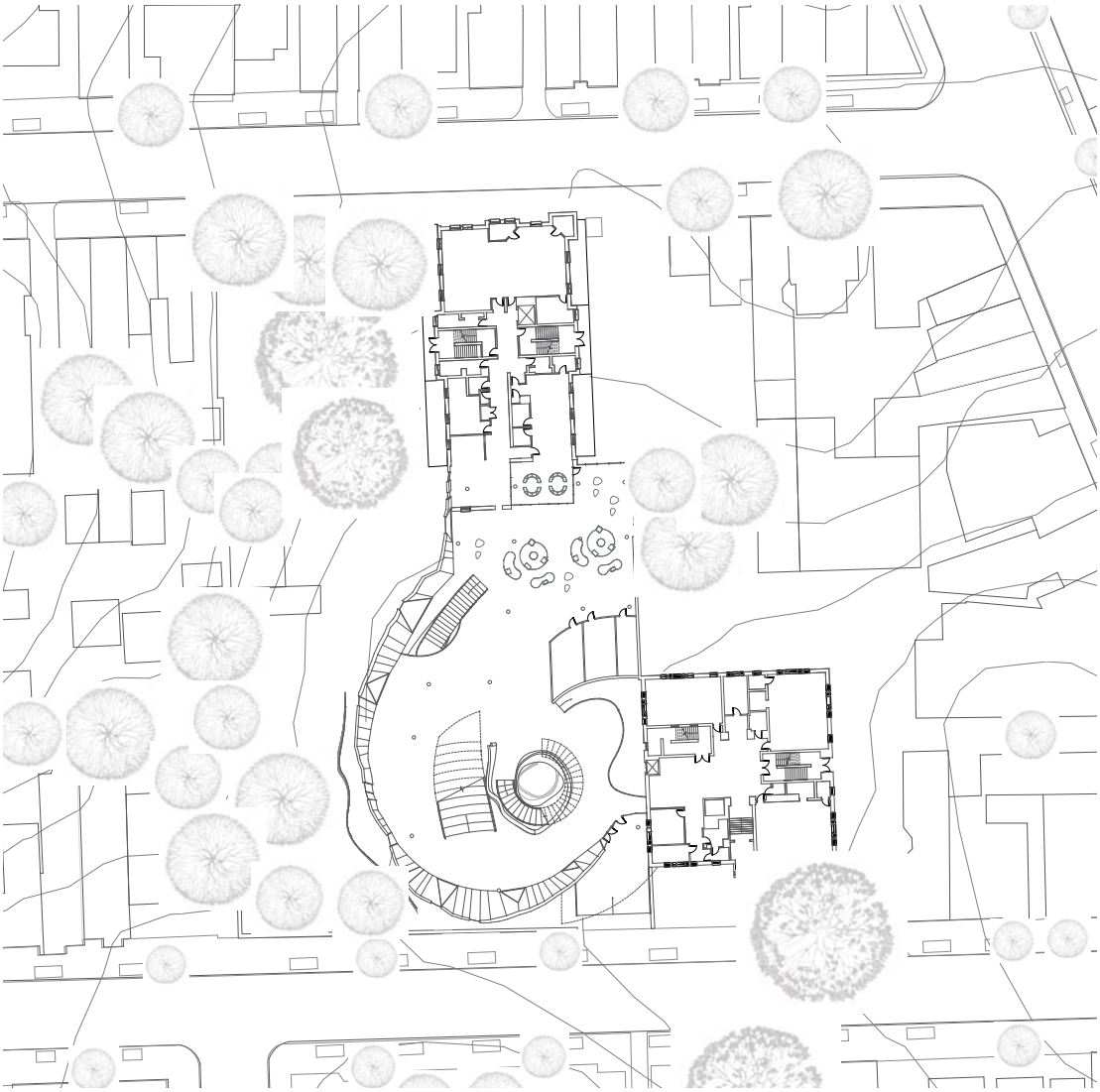

Figure 8. 5: Ground level plan (source: author)

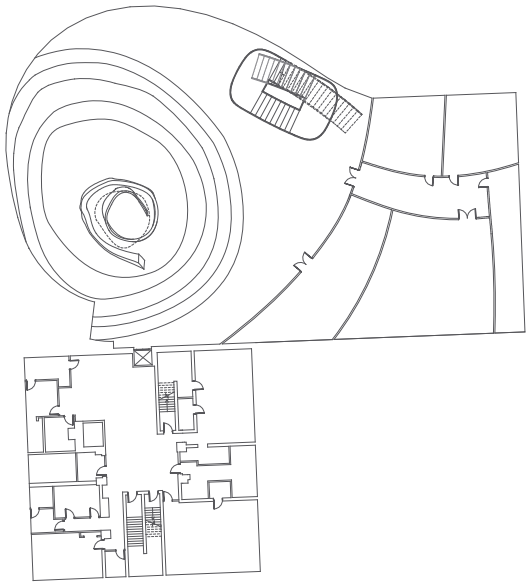

Figure 8. 6: Lower level plan (source: author)

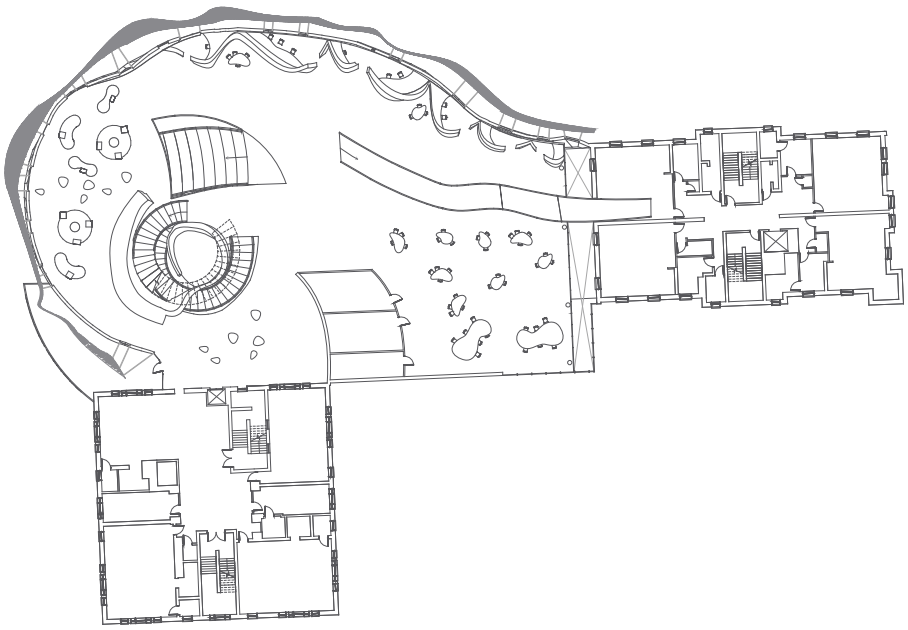

Figure 8. 7: Second level plan (source: author)

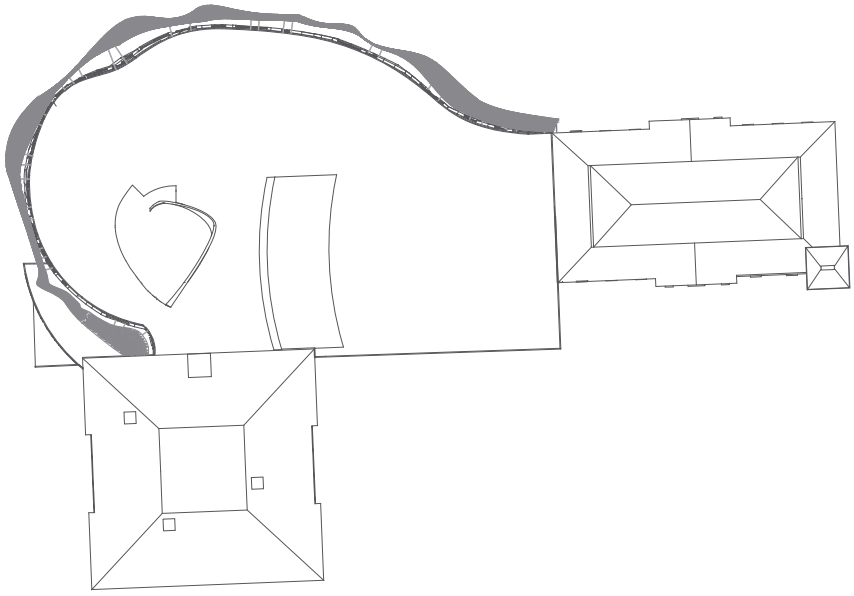

Figure 8. 8: Roof plan (source: author)

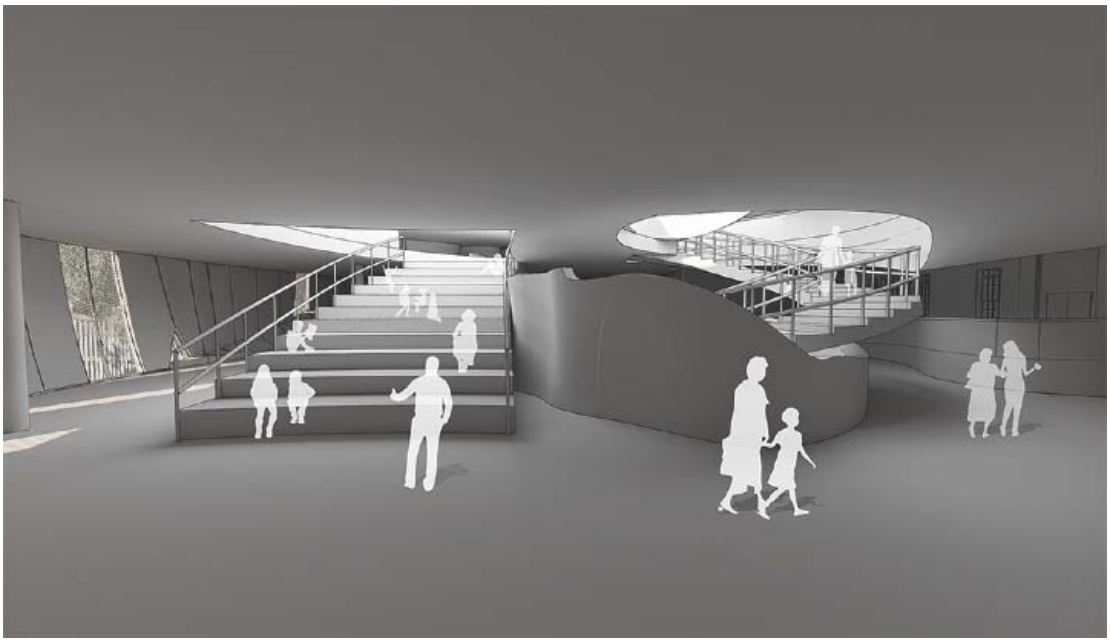

Figure 8. 9: Perspective view of the amphitheater and the oculus (source: author)

Figure 8. 10: Perspective view of the oculus (source: author)

Figure 8. 11: Perspective view of the performance space (source: author)

Figure 8. 12: Perspective view from the ramp (source: author)

Figure 8. 13: Perspective view of the casual eating area (source: author)

Figure 8. 14: Perspective view of the wateringhole (source: author)

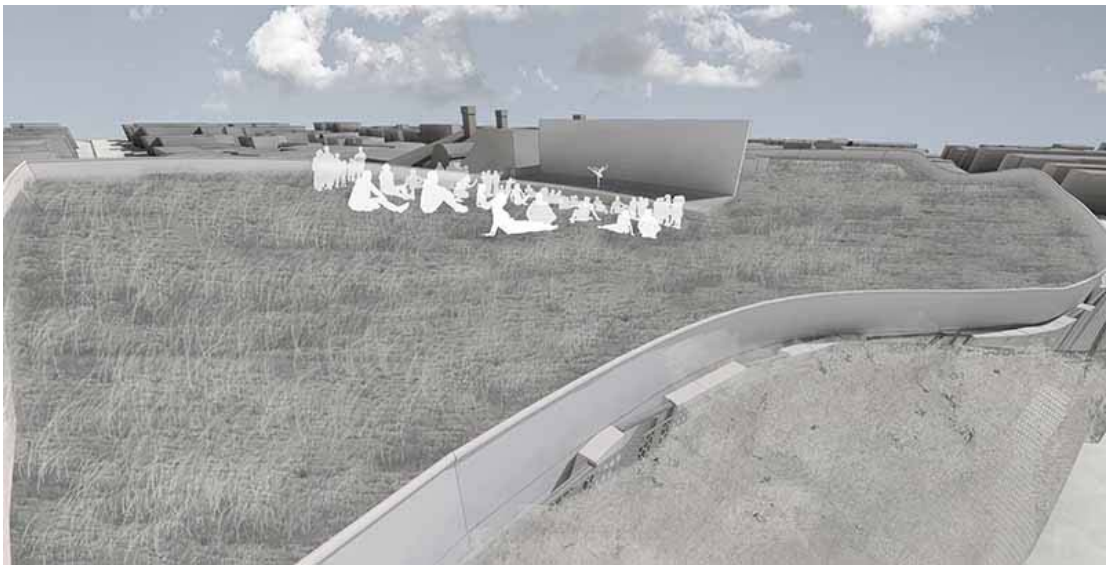

Figure 8. 15: Perspective view of the roof (source: author)

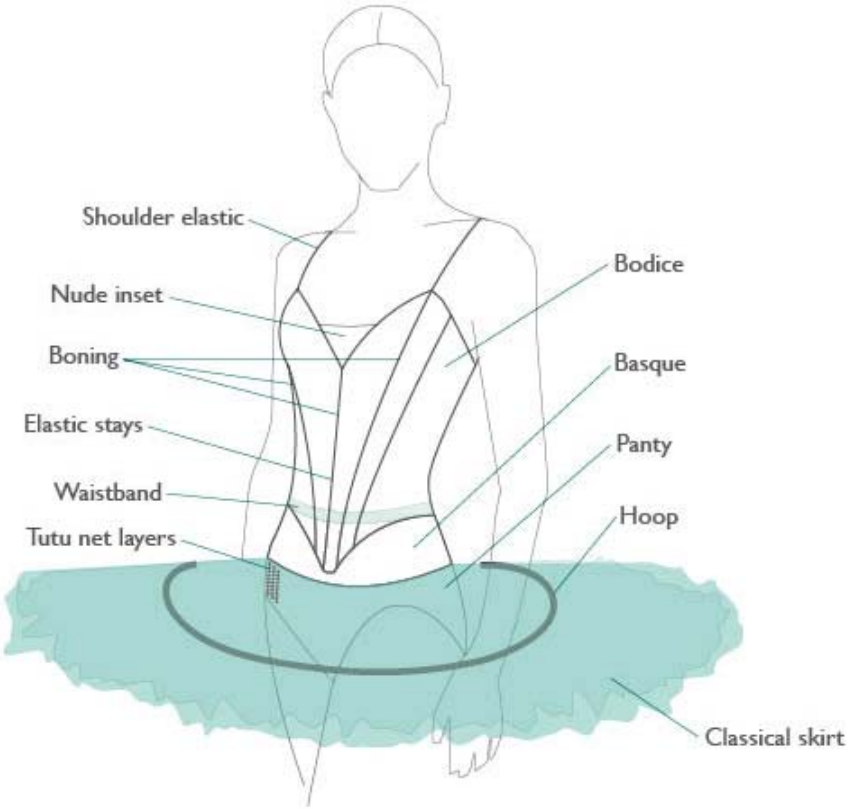

Figure 8. 16: Analysis of the ballet tutu (source: author)

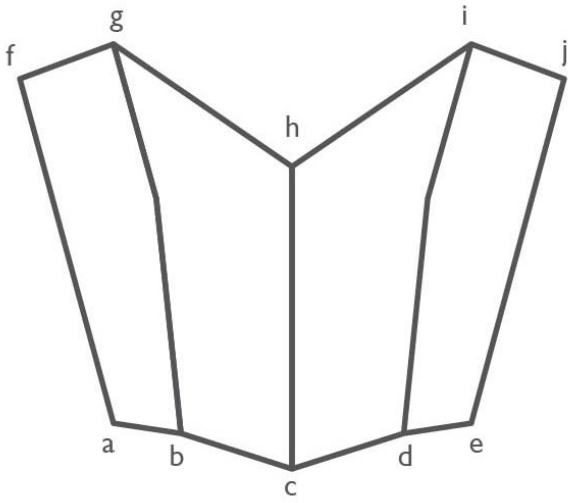

Figure 8. 17: Bodice panel (source: author)

Figure 8. 18: Series of bodice panels (source: author)

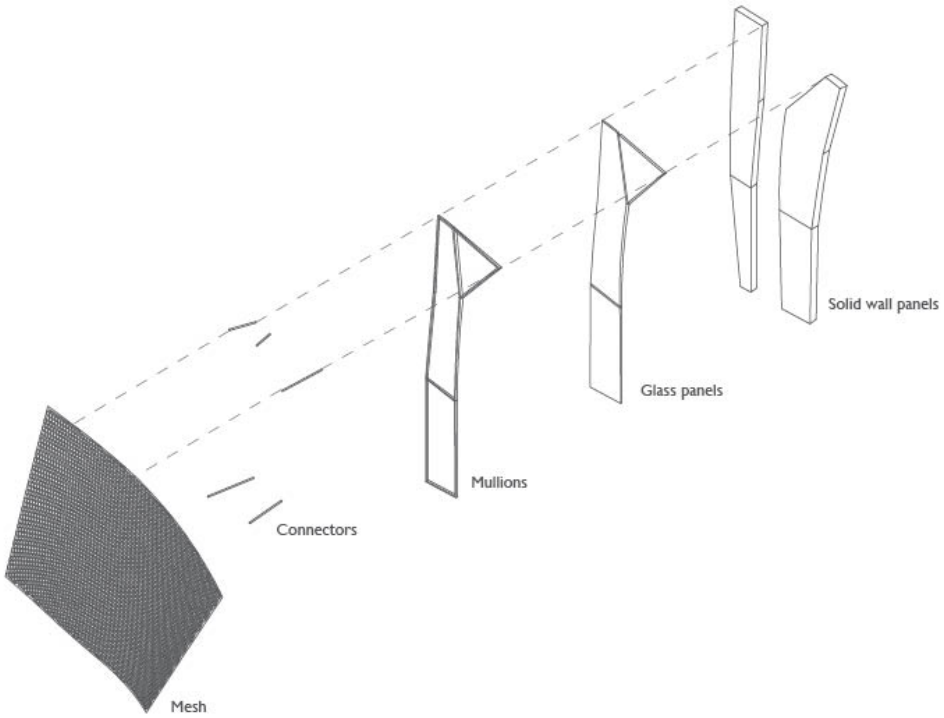

Figure 8. 19: Wall system (source: author)

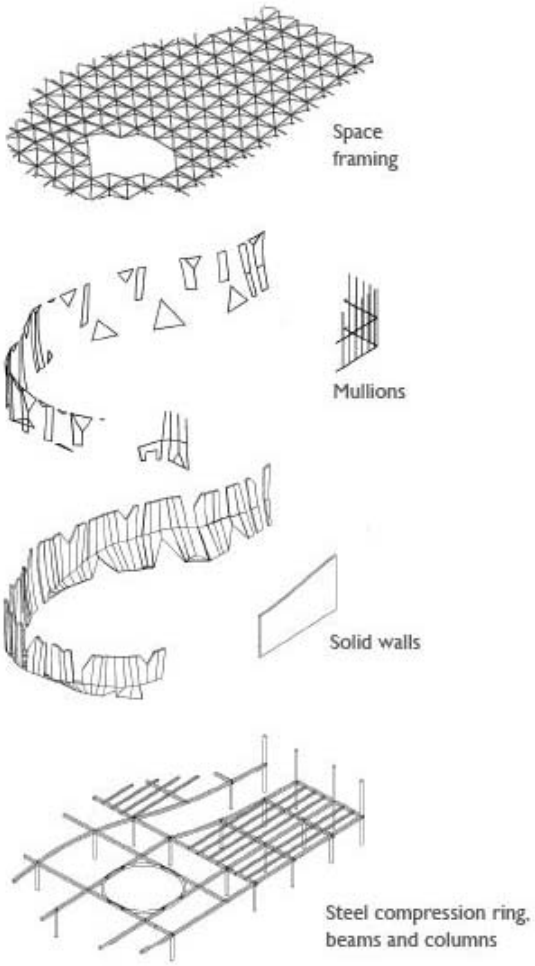

Figure 8. 20: Structural system (source: author)

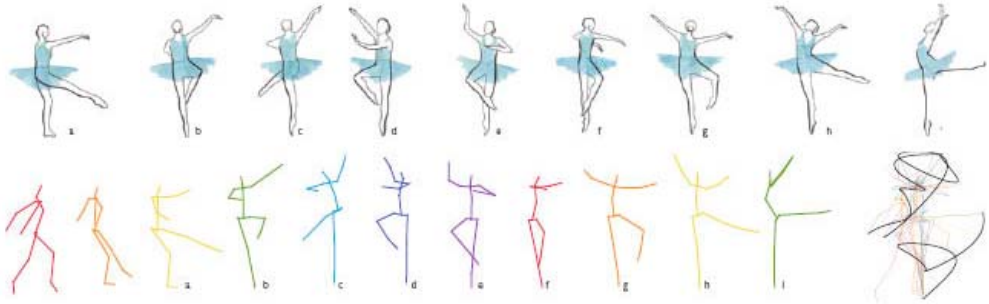

Figure 8. 21: Analysis of the pirouette (source: author)

Glossary

Contemporary Ballet: incorporates classical and modern dance; just like neoclassical ballet, it roots from classical ballet techniques but has greater range of movement of the upper body

Dancing architecture: visual capture of dance forms, an idea that implies movement in experiential architecture

Energy: defines the "how" aspect of dance

Kinetic energy: energy that is accelerated into motion

Labanotation: system of graphic representation of dance through notation

Neoclassical ballet: type of ballet that has no story line, but instead focuses more on the dance itself and how it is choreographed to the music

Potential energy: energy that is stored right before that energy is spent
Vivisection: to cut an object in parallel section planes, then support each plane by frames

Pirouette: an act of spinning on one foot while the other leg is raised to the knee of the turning leg

Tutu: a dress/costume worn for ballet performances

Bodice: a corset-like jacket that covers the torso of the dancer, made up of many panels that are seamed together

Basque: an extension of the bodice that goes past the waistline

Skirt: a projecting skirt of the tutu that is often made of layers of soft, mesh-like fabric

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